Halving Greenhouse Gases by 2020

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Global Climate Change: Transportation's Role in Reducing Greenhouse Gas Emissions

The Challenge

- Climate scientists recommend up to 80% reductions in GHG by 2050, worldwide, across all sectors
- Achieving GHG reductions may be more costly for transportation than other sectors
- How can the U.S. achieve transportation GHG reductions of **50-80%** by 2050?

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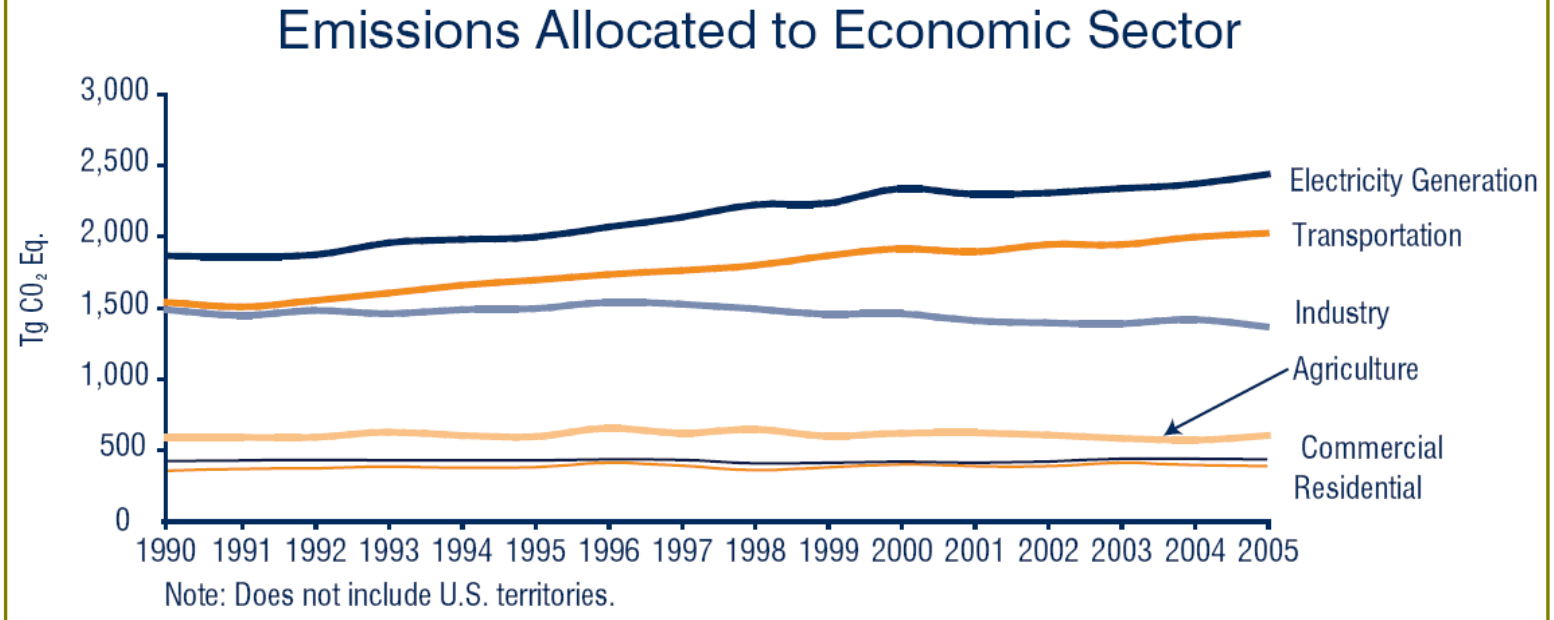
Complicating the Challenge: Transportation is 28% of U.S. GHG – and Rising



Source: INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2005 (April 2007) Fast Facts USEPA #430-F-07-004

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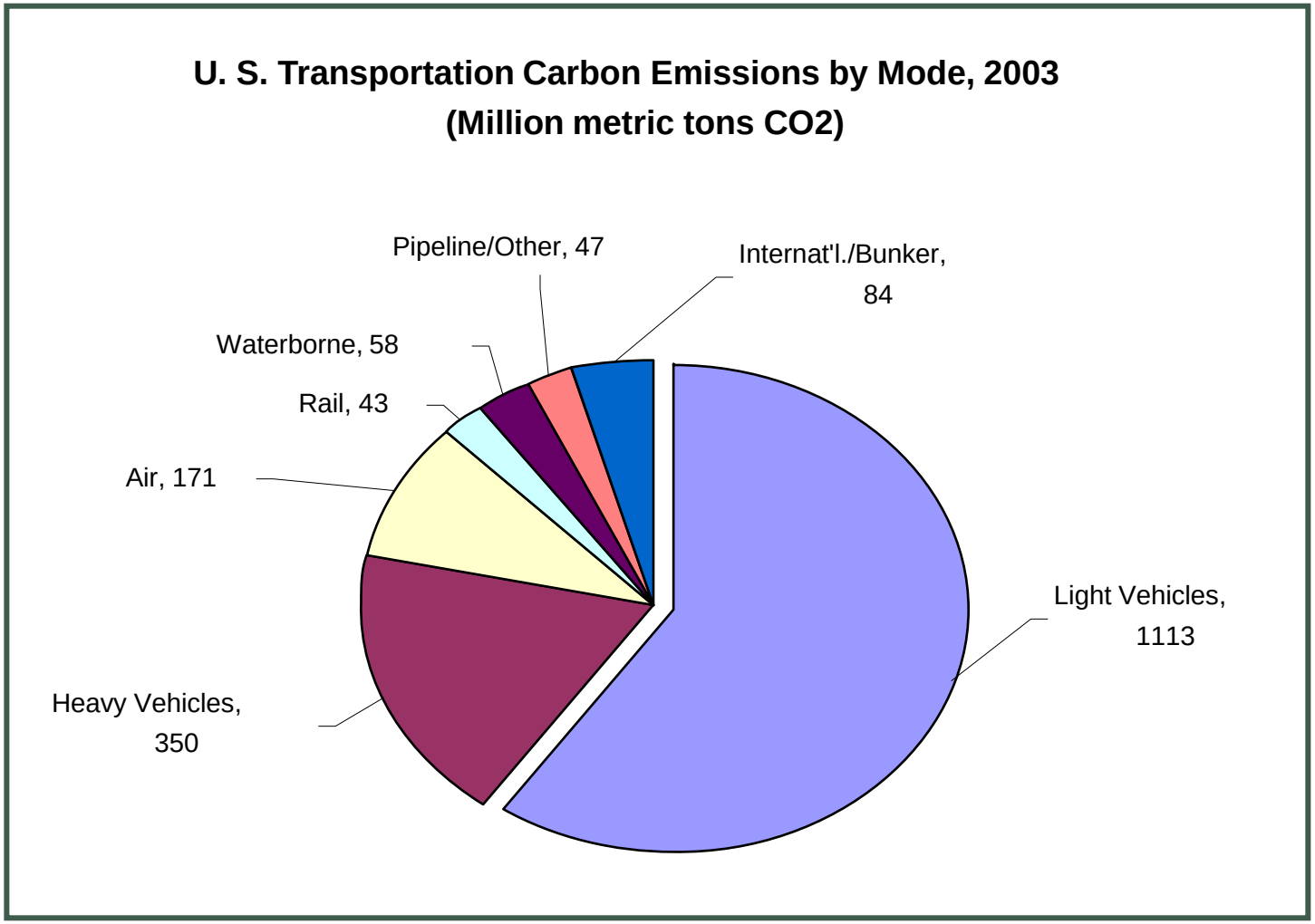
Highway Vehicles Account for 80% of Transportation Carbon Emissions



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Reducing Transportation GHG

- Surface transportation GHG is a function of:
  1. Vehicle efficiency
  2. Fuels
  3. VMT
  4. Operational efficiency of drivers and highway systems
  5. GHG associated with construction and maintenance

- Achieving 50-80% reductions in surface transportation GHG will require change in all five areas

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Vehicle/Fuel Improvements Will be the Major Source of GHG Reductions

- 50% cut in GHG/mile is feasible by 2030 from conventional technologies and biofuels
- CA GHG standard could attain this for new vehicles by 2020
- Almost complete decarbonization of LDVs and fuels is “a realistic ambition” with advanced technology/fuels
- Electric vehicles and certain biofuels are promising – but many technology and economic issues must be overcome
- 2004 NAS study assumed Hydrogen Fuel Cell Vehicles at ~78 mpgge by 2050

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Vehicle "Decarbonization" is Necessary

"In the long term, carbon free road transport fuel is the only way to achieve an 80-90% reduction in emissions, essentially "decarbonization."

--The King Review for the U.K. Government, by Professor Julia King, Vice-Chancellor of Aston University and former Director of Advanced Engineering at Rolls-Royce plc, March 2008

"[I]n the period beyond 2100, total GHG emissions will have to be just 20% of current levels. It is impossible to imagine this without decarbonization of the transport sector."

-- Sir Nicholas Stern, Stern Review to the U.K. Government, 2007

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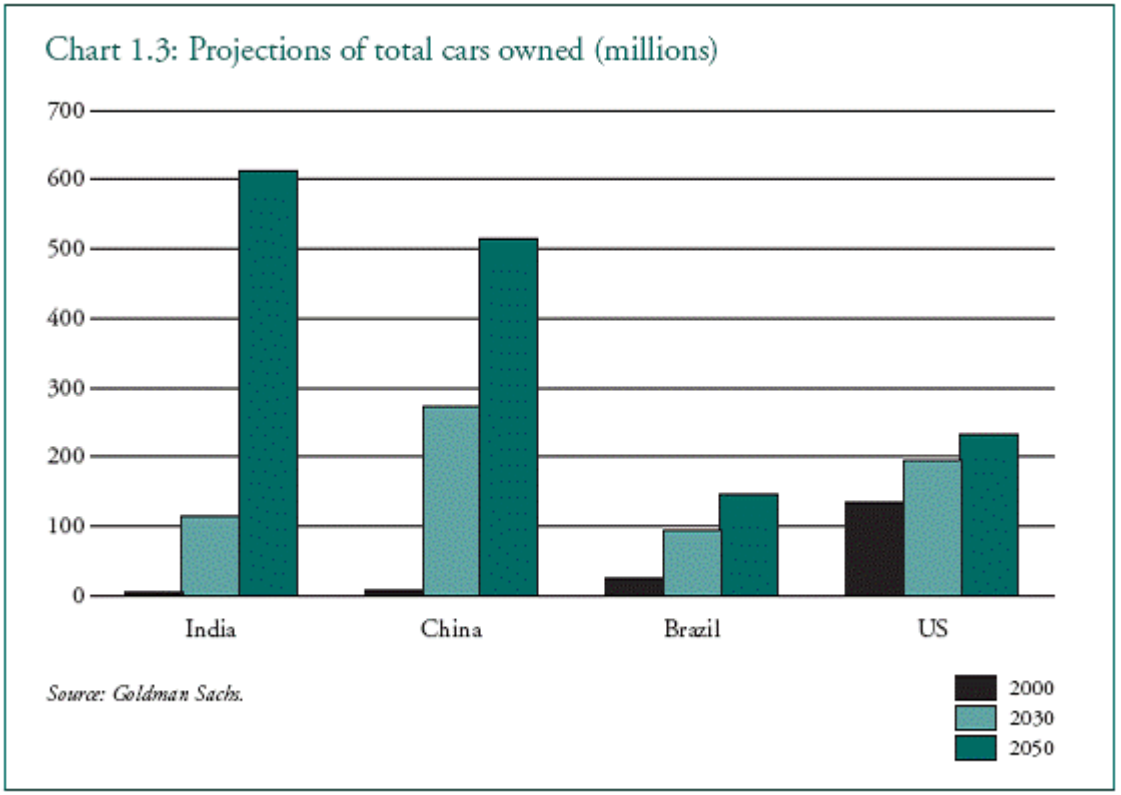
Worldwide Car Ownership Rising Dramatically



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But more is needed

- We can't be sure vehicle and fuel improvements will be sufficient to meet 50-80% reductions by 2050
- We also need near-term strategies
- Lowering VMT growth and improving operating efficiency of vehicles and highways are also needed

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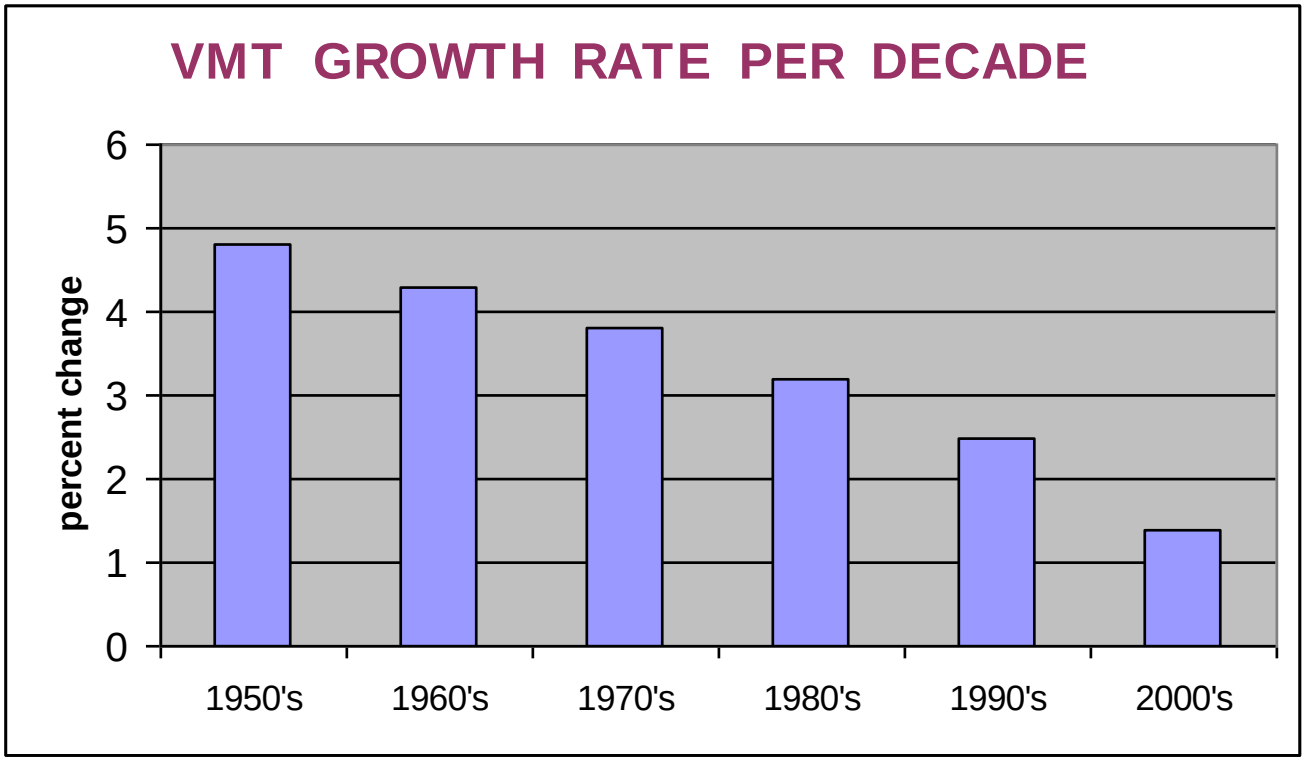
VMT Growth Trends

- VMT growth has been steadily declining since the 1950s
- VMT growth slowed to about 1.5% in early 2000s
- VMT growth was actually negative in 2008
- VMT is affected by population, economy, transportation prices, demographics, land use



Source: Alan Pisarski and Cambridge Systematics

CO_2e Emissions Per Passenger Mile for Various Modes

NATIONAL AVERAGE	Energy Intensities		Load Factor	CO_2e
	(Btu or kWhr per vehicle mile)	(Btu or kWhr per passenger mile)	Persons Per Vehicle	(Estimated Pounds CO_2e Per Passenger Mile)
Single Occupancy Vehicle (SOV) LDVs	5,987	5,987	1.00	0.99
Personal Trucks at Average Occupancy	6,785	4,329	1.72	0.71
Transit Bus	37,310	4,318	8.80	0.71
Cars at Average Occupancy	5,514	3,496	1.57	0.58
Electric Trolley Bus	5.2	0.39	13.36	0.52
High Occupancy Vehicle (HOV) LDVs at 2+ Occupancy	5,987	2,851	2.10	0.47
Intercity Rail (Amtrak)	54,167	2,760	20.50	0.39
Light and Heavy Rail Transit	62,797	2,750	22.50	0.39
Motorcycles	2,226	2,272	1.20	0.37
Commuter Rail	92,739	2,569	31.30	0.36
Vanpool	8,048	1,294	6.10	0.21
Walking or Biking	-	-	1.00	0.00

REGIONAL EXAMPLE (SEATTLE/PUGET SOUND REGION)	Energy Intensities		Load Factor	CO_2e
	(Btu or kWhr per vehicle mile)	(Btu or kWhr per passenger mile)	Persons Per Vehicle	(Estimated Pounds CO_2e Per Passenger Mile)
Cars (64%) and Personal Trucks (36%) at Average Occupancy	5,987	4,468	1.34	0.74
King County Metro Diesel and Hybrid Buses	33,024	2,854	11.57	0.47
Sound Transit Buses	33,024	2,517	13.12	0.42
King County Electrically-Powered Trolley Buses	5.33	0.44	12.12	0.11

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Many Strategies to Reduce LDV VMT

- Economy-wide carbon cap and trade (raises fuel prices)
- Transportation pricing (PAYD insurance, parking pricing, tolls, higher user fees, cordon pricing, congestion pricing, etc.)
- Carpooling and vanpooling (currently carry 7 times as much work trip PMT as transit)
- Bike/ped and transit (but some transit is higher GHG than LDV)
- Trip chaining
- Tele-working, tele-shopping, tele-education, tele-medicine
- Compact land use

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VMT: Pricing

- Without price signals, trying to reduce VMT is swimming upstream
- Multiple pricing tools available: carbon/fuel prices, PAYD insurance, mileage fees, parking pricing, congestion pricing, etc.
- Pricing rewards prudent VMT choices, is cost effective, and produces revenue to invest in alternatives
- Key pricing opportunity: Federal or regional carbon prices or cap-and-trade programs

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When Transportation Costs Increase, How do Consumers Respond?

- When VMT dropped in 2008, where did it go?
- We know <2% of the lost VMT went to transit.
- We don't know what happened to the other 98% of the VMT drop.
- Likely: less vacation driving, trip-chaining, carpooling/vanpooling, fewer discretionary trips, telework, reduced shopping trips, less recreational travel.

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Transit Helps Reduce GHG– But % Potential is Small

- Transit serves 1% of passenger miles in the U.S., and 0% of freight in the U.S.
- APTA: Transit reduced GHG by 6.9 – 37 MMT in 2005 **-- this is 1.67% of U.S. transportation GHG**
- European Ministers of Transport caution: *"Modal shift policies are usually weak in terms of the quantity of CO2 abated …. Modal shift measures can be effective when well targeted, particularly when integrated with demand management measures. They can not, however, form the corner-stone of effective CO2 abatement policy….."*
- Transit serves other goals – and is seen as key to land use changes

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Land Use as a Strategy to Reduce Transportation GHG

- "Growing Cooler" finds compact mixed-use development can achieve 3.5-5% reduction in transportation GHG, 2007-2050
- Newer studies find lower GHG impacts from land use
- GC's assumptions of land use change are super-aggressive:
  - 67% of all development in place in 2050 will be constructed or rehabbed after 2005
  - 60-90% of that development is compact (comparable to 13.3 housing-units per acre)
  - Compact development has 30% less VMT than very sprawling development

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Operational Efficiency Can Achieve 10-20% GHG Reduction

- Ecodriving, ~5 to 10% GHG Reduction
- Reduced Speed Limits, ~4% Reduction with Enforcement
- Active Traffic Management, Up To ~10% Reduction on Affected Facilities
- Eliminating bottlenecks
- Rapid removal of traffic incidents
- Reduced idling of trucks and LDVs

Three Scenarios That Achieve 50 – 80% Reduction in LDV* GHG below 2005 by 2050

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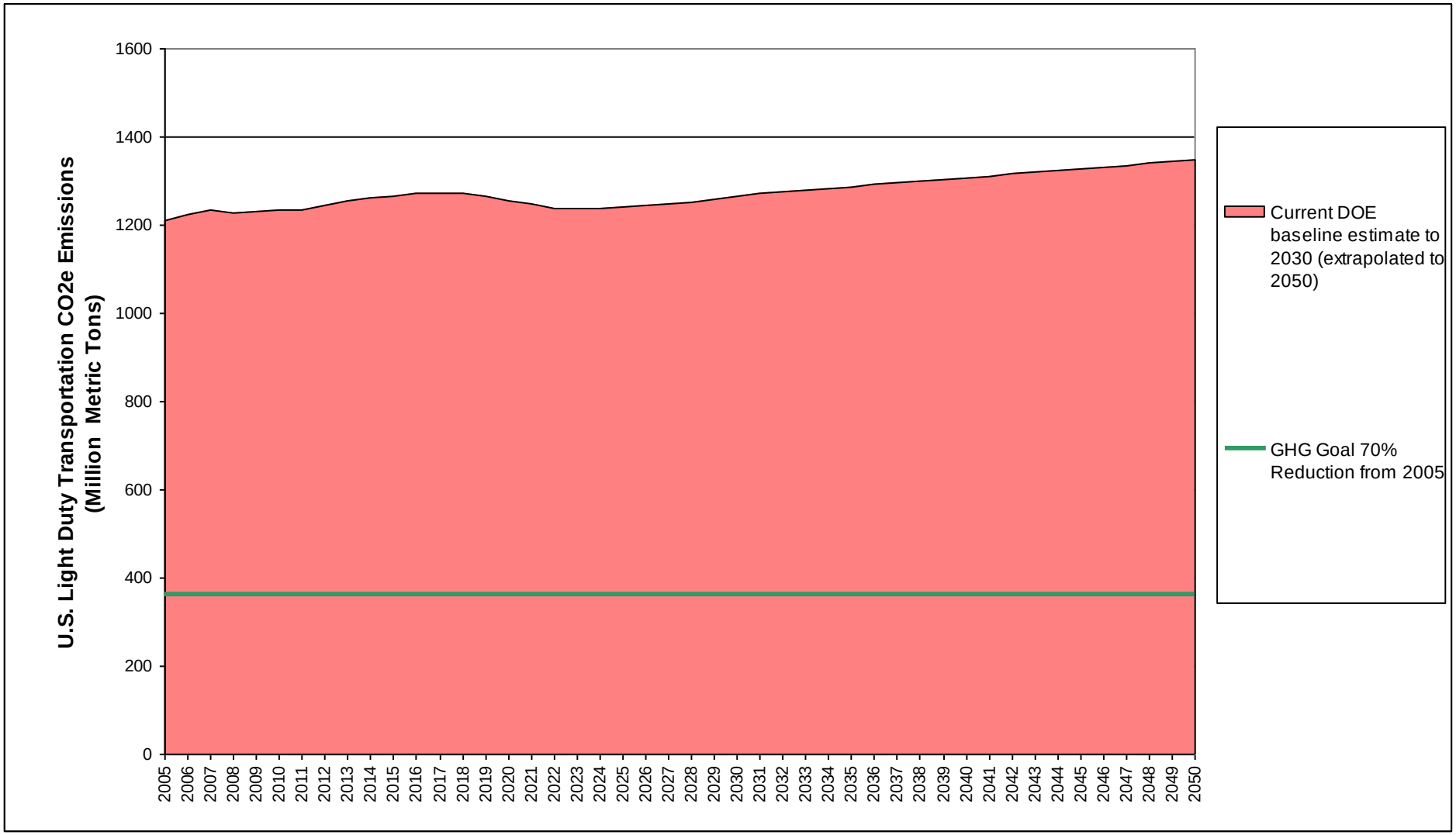
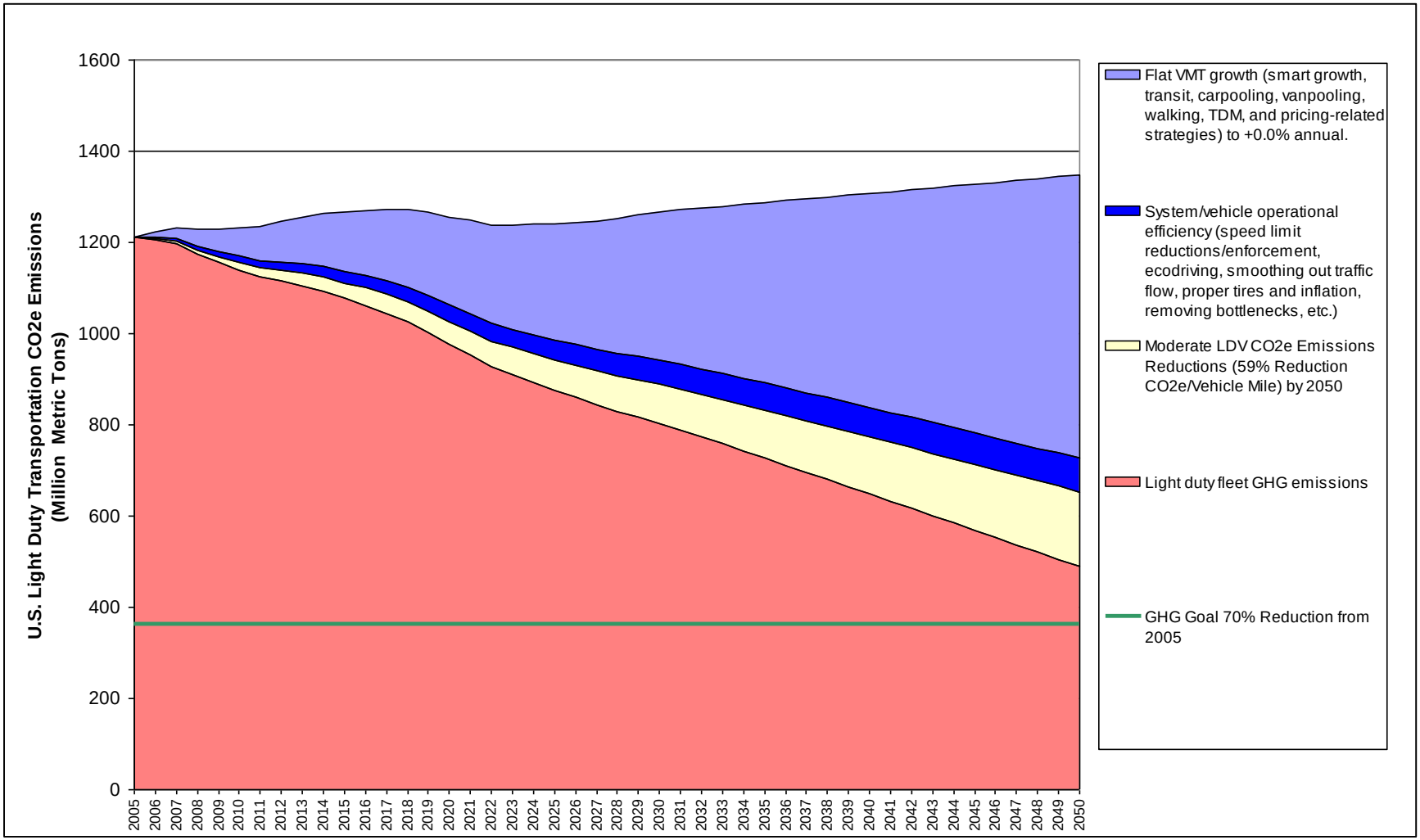
* LDV = light duty vehicles (cars and light trucks) – which represent almost 80% of surface transportation GHG

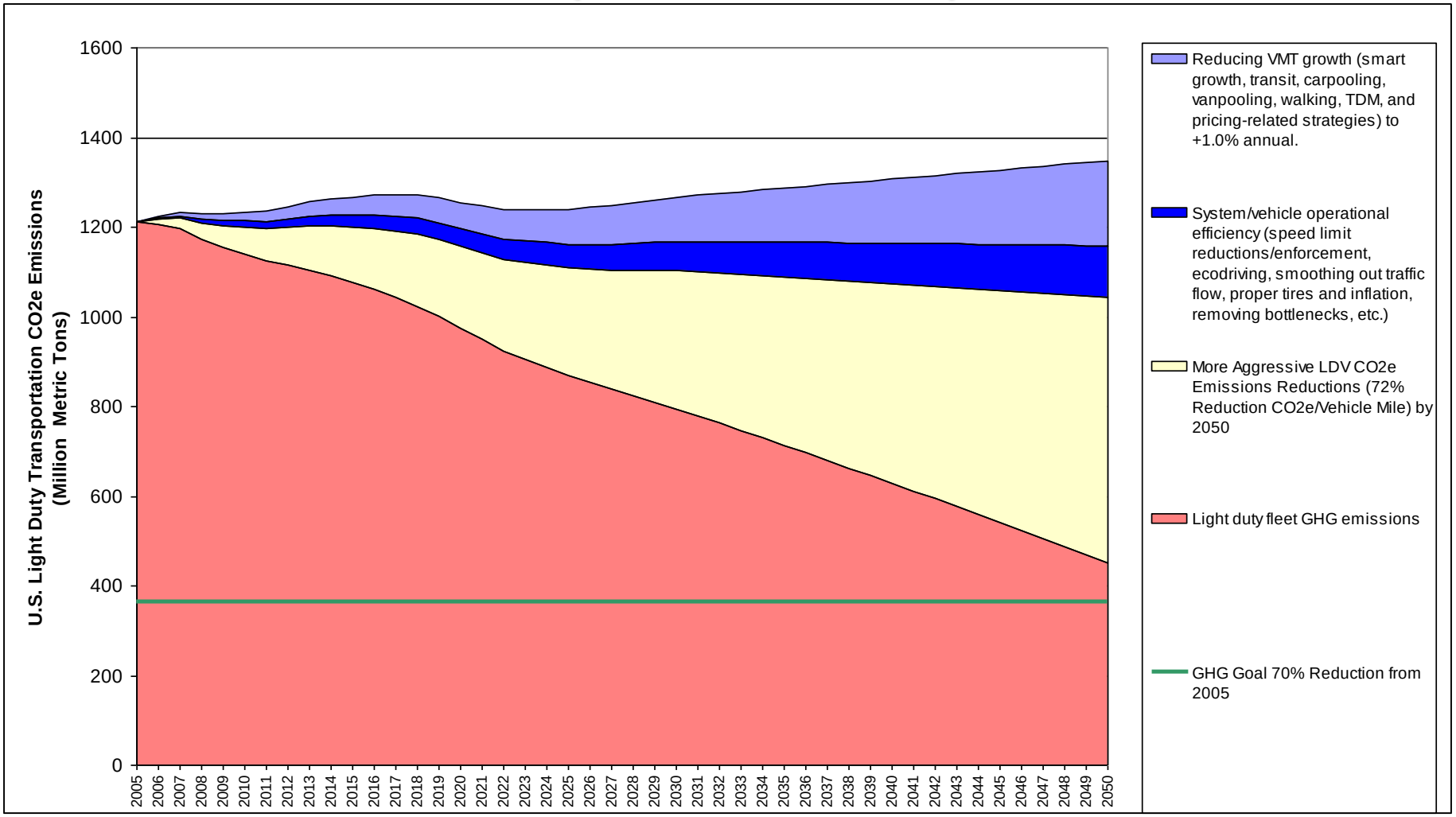
Baseline Scenario
(+11% LDV GHG)



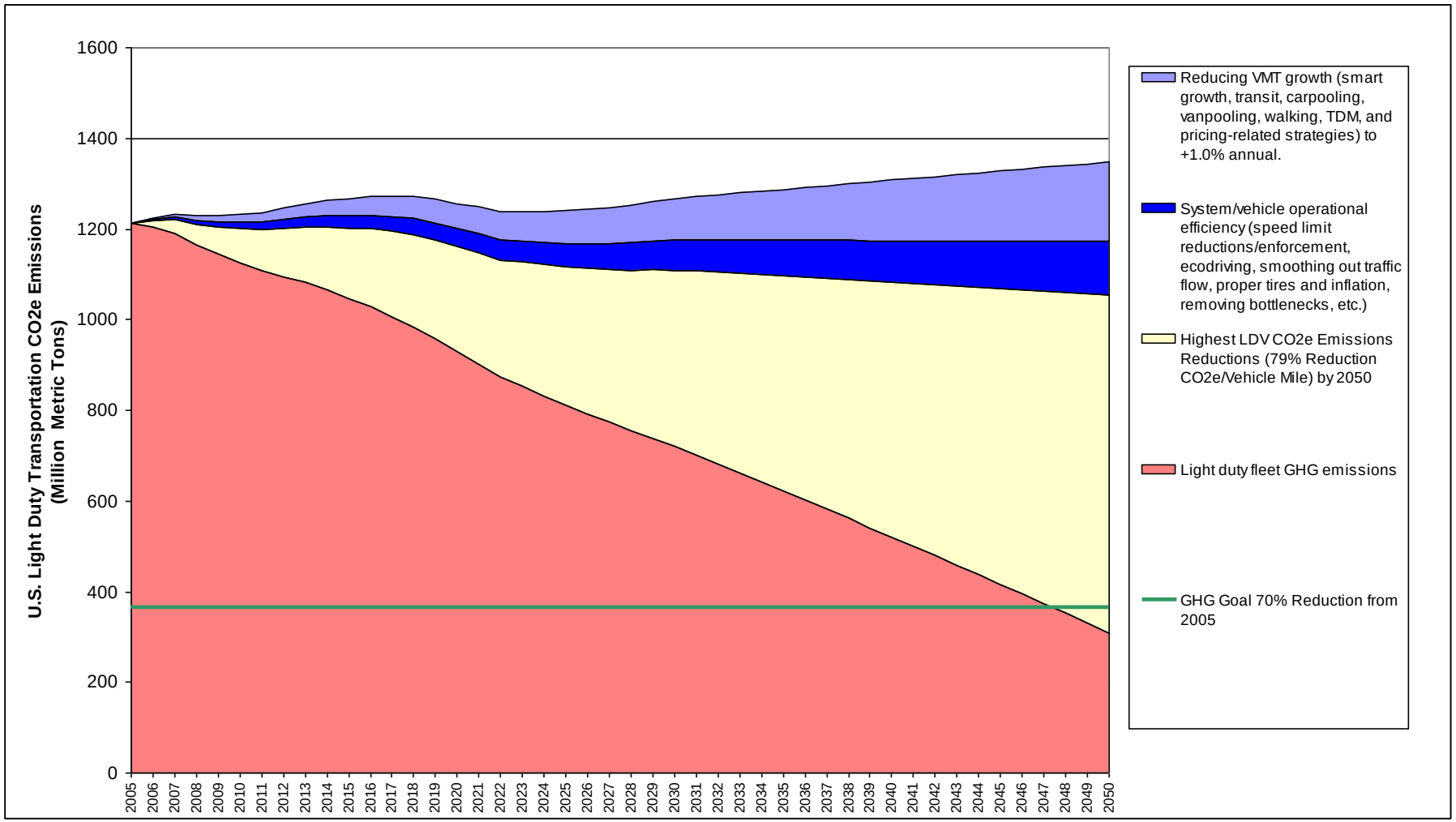
Scenario 1: Zero VMT Growth + 50 MPGGE for LDV Fleet + 5% Operational Efficiency (-60% LDV GHG)



Scenario 2: 1% Annual VMT Growth + 75 mpgge LDV Fleet + 10% Operational Efficiency (-63% LDV GHG)



Scenario 3: 1% Annual VMT Growth + 100 mpgge LDV Fleet + 10% Operational Efficiency (-74% LDV GHG)



Possible Implications

- To Reduce LDV GHG by 50 – 80% by 2050:
  - Major improvement in vehicles and fuels needed
  - Annual VMT growth ~ roughly 0% to 1%
  - For regions, annual p*er capita* VMT change needed ~ +0.1% to -0.8%
  - By 2050 per capita VMT would be 29% less to 7% more than 2005

European View (ECMT, 2006)

- "The most effective measures available include *fuel taxes, vehicle and component standards, differentiated vehicle taxation, support for eco-driving and incentives for more efficient logistic organization, including point of use pricing for roads*. "
- "More integrated transport and spatial planning policies might contain demand for motorized transport."
- Mode shifts … cannot … form the corner-stone of effective CO2 abatement policy and the prominence given to modal shift policies is at odds with indications that most modal shift policies achieve much lower abatement levels than measures focusing on fuel efficiency."
- "Ultimately higher cost energy sources …. will be required if there are to be further cuts in transport sector CO2 emissions."

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CONCLUSION: Many Strategies Needed to Reduce Transport GHG by 50-80% by 2050

1. TECHNOLOGY: (a) Maximize energy efficiency of conventional vehicles; and (b) develop/deploy carbon-neutral vehicle technology world-wide
2. PRICING: Adopt pricing measures to reward conservation and tech innovation
3. OPERATIONS: Push "eco driving" and system/speed management
4. LAND USE: Adopt more efficient land use
5. MODE SHIFTS: Support carpools & vanpools, biking, walking, transit use, trip chaining, telecommuting
6. CONSTRUCTION & MAINTENANCE: Adopt low carbon, energy-conserving strategies in construction, maintenance, and agency operations

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Thank you.

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